

# Contents

## Nuclear I&C

- The planning strategy of robotics technology for nuclear decommissioning in Taiwan  
*Chung Yi Tu, Kuen Tsann Chen, Kuen Ting, and Chin Yang Sheng* ..... 64
- Radiation-hardened-by-design preamplifier with binary weighted current source for radiation detector  
*Minuk Seung, Jong-Gyun Choi, Woo-young Choi, and Inyong Kwon* ..... 189
- Design of power and phase feedback control system for ion cyclotron resonance heating in the  
Experimental Advanced Superconducting Tokamak  
*L.N. Liu, W.M. Zheng, X.J. Zhang, H. Yang, S. Yuan, Y.Z. Mao, W. Zhang, G.H. Zhu, L. Wang, C.M. Qin,  
Y.P. Zhao, Y. Cheng, and K. Zhang* ..... 216

## Nuclear Fuel Cycle and Radioactive Waste Management

- Molybdenum release from high burnup spent nuclear fuel at alkaline and hyperalkaline pH  
*Sonia García-Gómez, Javier Giménez, Ignasi Casas, Jordi Llorca, Joan De Pablo, Albert Martínez-Torrents,  
Frederic Clarens, Jakub Kokinda, Luis Iglesias, and Daniel Serrano-Purroy* ..... 34
- Electrochemical extraction of uranium on the gallium and cadmium reactive electrodes in molten salt  
*Valeri Smolenski and Alena Novoselova* ..... 42
- In-pile tritium release behavior and the post-irradiation experiments of  $\text{Li}_4\text{SiO}_4$  fabricated by melting  
process  
*Linjie Zhao, Mao Yang, Chengjian Xiao, Yu Gong, Guangming Ran, Xiaojun Chen, Jiamao Li, Lei Yue,  
Chao Chen, Jingwei Hou, Heyi Wang, Xinggui Long, and Shuming Peng* ..... 106
- X-Ray Diffraction line profile analysis of defects and precipitates in high displacement damage neutron-  
irradiated austenitic stainless steels  
*Shreevalli M., Ran Vijay Kumar, Divakar R., Ashish K., Padmaprabu C., Karthik V., and Archana Sagdeo* ..... 114
- Searching for the viability of using thorium-based accident-tolerant fuel for VVER-1200  
*Mohamed Y.M. Mohsen, Mohamed A.E. Abdel-Rahman, Ahmed Omar, Nassar Alnassar, and  
A. Abdelghafar Galahom* ..... 167
- Effects of environmental parameters on chloride-induced stress corrosion cracking behavior of  
austenitic stainless steel welds for dry storage canister application  
*Seunghyun Kim, Gidong Kim, Chan Kyu Kim, and Sang-Woo Song* ..... 317

## Nuclear Policy, Economics, and Human Resource Development

- Does nuclear energy reduce consumption-based carbon emissions: The role of environmental taxes and  
trade globalization in highest carbon emitting countries  
*Muhammad Yasir Mehboob, Benjiang Ma, Muhammad Sadiq, and Yunsheng Zhang* ..... 180
- Modular reactors: What can we learn from modular industrial plants and off site construction research  
*Paul Wrigley, Paul Wood, Daniel Robertson, Jason Joannou, Sam O'Neill, and Richard Hall* ..... 222
- Artificial intelligence approach for linking competences in nuclear field  
*Vincent Kuo, Günther H. Filz, and Jussi Leveinen* ..... 340

## Nuclear Physics, Fusion, and Laser Technology

- Development of a low energy ion irradiation system for erosion test of first mirror in fusion devices  
*Kihyun Lee, YoungHwa An, Bongki Jung, Boseong Kim, and Yoo kwan Kim* ..... 70
- Design and simulation of 500 MHz single cell superconducting RF cavity for SILF  
*Yanbing Sun, Wei Ma, Nan Yuan, Yulin Ge, Zhen Yang, Liping Zou, and Liang Lu* ..... 195
- Investigating the effect of changing parameters in the IEC device in comparative study  
*H. Ghammas and M.N. Nasrabadi* ..... 292



# Contents

## Nuclear Structural Analysis /Plant Management & Maintenance

Thermal aging of Gr. 91 steel in supercritical thermal plant and its effect on structural integrity at elevated temperature Min-Gu Won, Si-Hwa Jeong, Nam-Su Huh, Woo-Gon Kim, and Hyeong-Yeon Lee .....	1
Pump availability prediction using response surface method in nuclear plant Parasuraman Suganya, Ganapathiraman Swaminathan, and Bhargavan Anoop .....	48
Numerical investigation on seismic performance of reinforced rib-double steel plate concrete combination shear wall Longyun Zhou, Xiaohu Li, and Xiaojun Li.....	78
Development of a new CVAP structural analysis methodology of APR1400 reactor internals using scaled model tests Jongsung Moon, Inseong Jin, Doyoung Ko, and Kyuhyung Kim.....	309

## Nuclear Safety

A study on transport and plugging of sodium aerosol in leak paths of concrete blocks Sujatha Pavan Narayanam, Soubhadra Sen, Kalpana Kumari, Amit Kumar, Usha Pujala, V. Subramanian, S. Chandrasekharan, R. Preetha, and B. Venkatraman.....	132
Comparison of event tree/fault tree and convolution approaches in calculating station blackout risk in a nuclear power plant Man Cheol Kim.....	141
Impingement wastage experiment with SUS 316 in a printed circuit steam generator Siwon Seo, Bowon Hwang, Sangji Kim, and Jaeyoung Lee.....	257
Characteristics of debris resulting from simulated molten fuel coolant interactions in SFRS E. Hemanth Rao, Prabhat Kumar Shukla, D. Ponraju, and B. Venkatraman .....	283

## Radiation Application

Development of a real-time gamma camera for high radiation fields Minju Lee, Yoonhee Jung, and Sang-Han Lee .....	56
Measurements of proton beam flux and energy of APEP using foil activation technique Wenlin Li, Qifan Dong, Hantao Jing, Li Ou, Zhixin Tan, Sixuan Zhuang, and Qingbiao Wu .....	328

## Radiation protection

A proposal on multi-agent static path planning strategy for minimizing radiation dose Minjae Lee, SeungSoo Jang, Woosung Cho, Janghee Lee, CheolWoo Lee, and Song Hyun Kim.....	92
Artificial neural network approach for calculating mass attenuation coefficient of different glass systems A. Benhadjira, M.I. Sayyed, O. Bentouila, and K.E. Aiadi .....	100
X-band EPR dosimetry using minimum mass of tooth enamel for use in radiological accidents Jae Seok Kim, Byeong Ryong Park, Han Sung Kim, In Mo Eo, Jaeryong Yoo, Won Il Jang, Minsu Cho, Hyojin Kim, and Yong Kyun Kim.....	123
Optimized inverse distance weighted interpolation algorithm for $\gamma$ radiation field reconstruction Biao Zhang, Jinjia Cao, Shuang Lin, Xiaomeng Li, Yulong Zhang, Xiaochang Zheng, Wei Chen, and Yingming Song .....	160





# Contents

Radionuclide concentrations in agricultural soil and lifetime cancer risk due to gamma radioactivity in district Swabi, KPK, Pakistan <i>Umair Azeem, Hannan Younis, Niamat ullah, Khurram Mehboob, Muhammad Ajaz, Mushtaq Ali, Abdullah Hidayat, and Wazir Muhammad</i> .....	207
Calculation of X-ray attenuation coefficients for normal and cancerous breast tissues <i>Aysun Böke</i> .....	241
Optical, thermal and gamma ray attenuation characteristics of tungsten oxide modified: $B_2O_3$ - $SrCO_3$ - $TeO_2$ - $ZnO$ glass series <i>Hammam Abdurabu Thabit, Abd Khamim Ismail, M.I. Sayyed, S. Hashim, I. Abdullahi, Mohamed Elsaft, K. Keshavamurthy, and G. Jagannath</i> .....	247
Radiation attenuation and elemental composition of locally available ceramic tiles as potential radiation shielding materials for diagnostic X-ray rooms <i>Mohd Aizuddin Zakaria, Mohammad Khairul Azhar Abdul Razab, Mohd Zulfadli Adenan, Muhammad Zabidi Ahmad, Suffian Mohamad Tajudin, Damilola Oluwafemi Samson, and Mohd Zahri Abdul Aziz</i> .....	301
Evaluation of exposure to ionizing radiation of medical staff performing procedures with glucose labeled with radioactive fluorine - $^{18}F$ -FDG <i>Michał Biegała, Marcin Brodecki, Teresa Jakubowska, and Joanna Domienik-Andrzejewska</i> .....	335
<b>Reactor Physics</b>	
Conceptual design study on Plutonium-238 production in a multi-purpose high flux reactor <i>Jian Li, Jing Zhao, Zhihong Liu, Ding She, Heng Xie, and Lei Shi</i> .....	147
<b>Thermal Hydraulics</b>	
In-depth investigation of natural convection thermal characteristics of BALI experiment through Eulerian computational fluid dynamics code and comparison with Lagrangian code <i>Hyeonggi Moon, Sohyun Park, Eungsoo Kim, and Jae-Ho Jeong</i> .....	9
Development of a one-dimensional system code for the analysis of downward air-water two-phase flow in large vertical pipes <i>Donkoan Hwang, Soon Ho Kang, Nakjun Choi, and Hangjin Jo</i> .....	19
Numerical simulation of a toroidal single-phase natural circulation loop with a $k$ - $kL$ - $\omega$ transitional turbulence model <i>Yiwa Geng, Xiongbin Liu, Xiaotian Li, and Yajun Zhang</i> .....	233
Thermo-hydrodynamic investigation into the effects of minichannel configuration on the thermal performance of subcooled flow boiling <i>Amal Igaadi, Rachid El Amraoui, and Hicham El Mghari</i> .....	265
Temperature analysis of extra vessel electromagnetic pump cooling for a Micro nuclear reactor with an electric power of 20 MW <i>Tae Uk Kang and Hee Reyoung Kim</i> .....	275
Corrigendum to “Thermal-hydraulic safety analysis of radioisotope production in HANARO using MCNP6 and COMSOL multiphysics: A feasibility study” [NET 55(2023) p.3997] <i>Taeyun Kim, Bo-Young Han, Seongwoo Yang, Jaegi Lee, Gwang-Min Sun, Byung-Gun Park, and Sung-Joon Ye</i> .....	357

This journal was supported by the Korean Federation of Science and Technology Societies Grant funded by the Korean Government (Ministry of Education).

